Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States

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Initial Postnatal Management of the HIV-Exposed Neonate

Panel’s Recommendations

- A complete blood count and differential should be performed on newborns as a baseline evaluation (BIII).
- If hematologic abnormalities are identified in infants receiving prophylaxis, decisions on whether to continue infant antiretroviral (ARV) prophylaxis need to be individualized. Consultation with an expert in pediatric HIV infection is advised if early discontinuation of prophylaxis is considered (CIII).
- Decisions about the timing of subsequent monitoring of hematologic parameters in infants depend on baseline hematologic values, gestational age at birth, clinical condition of the infants, the zidovudine dose being administered, receipt of other ARV drugs and concomitant medications, and maternal antepartum therapy (CIII).
- Hemoglobin and neutrophil counts should be remeasured 4 weeks after initiation of prophylaxis for infants who receive combination zidovudine/lamivudine-containing ARV prophylaxis regimens (AI).
- Routine measurement of serum lactate is not recommended. However, measurement can be considered if an infant develops severe clinical symptoms of unknown etiology (particularly neurologic symptoms) (CIII).
- Virologic tests are required to diagnose HIV infection in infants aged <18 months and should be performed at 14 to 21 days of life and at ages 1 to 2 months and 4 to 6 months (AII).
- To prevent Pneumocystis jirovecii pneumonia (PCP), all infants born to HIV-infected women should begin PCP prophylaxis at ages 4 to 6 weeks, after completing their ARV prophylaxis regimen, unless there is adequate test information to presumptively exclude HIV infection (see the Pediatric Opportunistic Infections Guidelines) (AII).
- Health care providers should routinely inquire about breastfeeding and premastication; instruct HIV-infected caregivers to avoid these practices, and advise on safer feeding options (AII).

Rating of Recommendations: A = Strong; B = Moderate; C = Optional
Rating of Evidence: I = One or more randomized trials with clinical outcomes and/or validated laboratory endpoints; II = One or more well-designed, nonrandomized trials or observational cohort studies with long-term clinical outcomes; III = Expert opinion

Hematologic Toxicity

A complete blood count and differential should be performed on HIV-exposed newborns before initiation of infant antiretroviral (ARV) drug prophylaxis. Decisions about the timing of hematologic monitoring of infants after birth depend on a number of factors, including baseline hematologic values, gestational age at birth, clinical condition of the infants, which ARV drugs are being administered, receipt of concomitant medications, and maternal antepartum therapy. Anemia is the primary complication seen in neonates given the standard 6-week postnatal zidovudine regimen. In PACTG 076, infants in the zidovudine group had lower hemoglobin levels at birth than those in the placebo group, with the maximal difference (1 g/dL) occurring at age 3 weeks.1 The lowest mean value for hemoglobin levels (10 g/dL) occurred at age 6 weeks in the zidovudine group. By age 12 weeks, hemoglobin values in both groups were similar. No significant differences in other laboratory parameters were observed between groups.

Some experts remeasure hematologic values in healthy infants receiving zidovudine prophylaxis only if symptoms are present. Hematologic safety data are limited on administration of 4 mg/kg of zidovudine twice daily in infants. When administering this dosing regimen, some experts remeasure hemoglobin and neutrophil counts routinely after 4 weeks of zidovudine prophylaxis and/or when diagnostic HIV polymerase chain reaction (PCR) tests are obtained.

In utero exposure to maternal combination ARV drug regimens may be associated with more anemia and/or neutropenia compared with that seen in infants exposed to zidovudine alone.2-5 In PACTG 316, where 77% of mothers received antenatal combination therapy, significant Grade 3 or higher anemia was noted in 13% and neutropenia in 12% of infants, respectively. Some experts recommend more intensive monitoring of...
hematologic and serum chemistry and liver function assays at birth and when diagnostic HIV PCR tests are obtained in infants exposed to combination ARV drug regimens in utero or during the neonatal period.

In addition, data are limited on infants receiving zidovudine in combination with other ARV drugs for prophylaxis. However, higher rates of hematologic toxicity have been observed in infants receiving zidovudine/lamivudine and other combination prophylactic regimens compared with those receiving zidovudine alone or zidovudine plus nevirapine.6-8 Hemoglobin levels and neutrophil counts, therefore, should be remeasured 4 weeks after initiation of prophylaxis and/or at the time that diagnostic HIV PCR testing is done in infants who receive combination zidovudine/lamivudine-containing ARV prophylaxis regimens.9

If hematologic abnormalities are found, decisions on whether to continue infant ARV prophylaxis need to be individualized. Considerations include the extent of the abnormality, whether related symptoms are present, duration of infant prophylaxis, and risk of HIV infection (as assessed by the mother’s history of ARV prophylaxis, viral load near delivery, and mode of delivery). In the United States, the standard 6-week infant zidovudine regimen has been recommended based on data from PACTG studies 076 and 316 (both performed during an era when women received zidovudine antenatal monotherapy). In the United Kingdom and other European countries, a 4-week neonatal chemoprophylaxis regimen is now recommended for infants born to mothers who have received antiretroviral therapy (ART) regimens and have viral suppression, with no apparent increase in the overall HIV perinatal transmission rate.10,11 Additionally, a 4-week zidovudine regimen has been reported to result in earlier recovery from anemia in otherwise healthy infants compared with the 6-week zidovudine regimen.12 Therefore, a 4-week zidovudine neonatal chemoprophylaxis regimen can be considered when a mother has received standard ART during pregnancy with consistent viral suppression and there are no concerns related to maternal adherence.

Hyperlactatemia

Hyperlactatemia has been reported in infants with in utero exposure to ARV drugs, but it appears to be transient and, in most cases, asymptomatic.13,14 Routine measurement of serum lactate is not recommended in asymptomatic neonates to assess for potential mitochondrial toxicity because the clinical relevance is unknown and the predictive value for toxicity appears poor.13,14 Serum lactate measurement should be considered, however, for infants who develop severe clinical symptoms of unknown etiology, particularly neurologic symptoms. In infants with symptoms, if the levels are significantly abnormal (>5 mmol/L), ARV prophylaxis should be discontinued and an expert in pediatric HIV infection should be consulted regarding potential alternate prophylaxis.

Prophylaxis Against Pneumocystis jirovecii Pneumonia

To prevent Pneumocystis jirovecii pneumonia, all infants born to HIV-infected women should begin trimethoprim-sulfamethoxazole prophylaxis at age 4 to 6 weeks, after completion of the infant ARV prophylaxis regimen, unless there is adequate virologic test information to presumptively exclude HIV infection (see the Pediatric OI Guidelines).15

HIV Testing of the Infant

HIV infection in infants should be diagnosed using HIV nucleic acid amplification virologic assays, which include DNA and RNA PCR and related assays. Maternal HIV antibody crosses the placenta and will be detectable in all HIV-exposed newborns; therefore, standard antibody tests should not be used for HIV diagnosis in newborns. HIV virologic testing should be performed at 14 to 21 days of life and at ages 1 to 2 months and 4 to 6 months.16 Some experts also perform a virologic test at birth, especially in women who have not had good virologic control during pregnancy or if adequate follow-up of the infant cannot be assured. A positive HIV virologic test should be confirmed as soon as possible with a second HIV virologic test on a different specimen. Two positive HIV tests constitute a diagnosis of HIV infection. There is no evidence of a delay in HIV diagnosis with HIV DNA PCR assays in infants who have received the zidovudine regimen.1,17 However, the effect of maternal or infant exposure to combination ARV drug
regimens on the sensitivity of infant virologic diagnostic testing—particularly using HIV RNA assays—is unknown. Therefore, some experts prefer to use HIV DNA PCR assays for diagnosing infection in neonates who receive combination ARV drug regimens. Any newly diagnosed infant should undergo viral resistance testing by genotype and/or phenotype to assess for susceptibility to ART.

HIV can be **presumptively** excluded with 2 or more negative tests: one at age 14 days or older and the other at age 1 month or older. **Definitive** exclusion of HIV in non-breastfed infants can be based on two or more negative virologic tests, with one test performed at age 1 month or older and the other test at age 4 months or older. Many experts confirm HIV-negative status with an HIV antibody test at age 12 to 18 months. Persistence of HIV antibodies can occasionally occur at or beyond age 18 months.\(^{13}\) Alternative algorithms exist for presumptive and definitive HIV exclusion.\(^{16}\) This testing algorithm applies mainly to exposure to HIV subtype B, which is the predominant viral subtype found in the United States. Non-subtype B viruses predominate in some other parts of the world. Non-subtype B infection may not be detected by many commercially available nucleic acid tests, particularly HIV DNA PCR. Many of the newer HIV RNA assays have improved detection of non-subtype B HIV, but there are still variants that are either poorly detected or undetectable. If non-subtype B HIV infection is suspected based on maternal origins, then newer HIV RNA assays that have improved ability to detect non-subtype B HIV should be used as part of the initial diagnostic algorithm. For a detailed discussion of pediatric HIV diagnosis, see the **Pediatric Guidelines**.

**Postnatal Management**

Following birth, HIV-exposed infants should have a detailed physical examination, and a thorough maternal history should be obtained. HIV-infected mothers may be coinfected with other pathogens that can be transmitted from mother to child, such as cytomegalovirus, *Zika virus*, herpes simplex virus, hepatitis B, hepatitis C, syphilis, toxoplasmosis, or tuberculosis. Infants born to mothers with such coinfections should undergo appropriate evaluation, as indicated by maternal CD4 T lymphocyte count and evidence of disease activity, to rule out transmission of additional infectious agents. The routine primary immunization schedule should be followed for HIV-exposed infants born to HIV-infected mothers. Modifications in the schedule for live virus vaccines may be required for infants with known HIV infection (see the **Pediatric OI Guidelines**).

No evidence is available to enable the Panel on Treatment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission to assess whether any changes in routine bathing practices, or timing of circumcision, are indicated for HIV-exposed newborns.

**Infant Feeding Practices and Risk of HIV Transmission**

In the United States, where safe infant feeding alternatives are available and free for women in need, HIV-infected women should not breastfeed their infants.\(^{19}\) Maternal receipt of ART is likely to reduce free virus in breast milk, but the presence of cell-associated virus (intracellular HIV DNA) remains unaffected and, therefore, may continue to pose a transmission risk.\(^{20}\) However, clinicians should be aware that women may face social, familial, and personal pressures to consider breastfeeding despite this recommendation. It is important to address possible barriers to formula feeding beginning during the antenatal period (see **Postpartum Follow Up**).

Late HIV transmission events in infancy have been reported in HIV-infected children suspected of acquiring HIV infection as a result of consuming premasticated food given to them by their caregivers. Phylogenetic comparisons of virus from cases and suspected sources and supporting clinical history and investigations identified the practice of feeding premasticated foods to infants as a potential risk factor for HIV transmission. Health care providers should routinely inquire about premastication, instruct HIV-infected caregivers against this feeding practice, and advise on safer feeding options.\(^{21,22}\)

**References**


*Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States*
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